



United States Department of the Interior

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File No. 1-5-00-F-518

Mr. Stephan Brocoun, Assistant Manager
Office of Licensing and Regulatory Compliance
U.S. Department of Energy
Post Office Box 30307
North Las Vegas, Nevada 89036-0307

Dear Mr. Brocoun:

Subject: Final Biological Opinion for the Effects of Construction, Operation and Monitoring, and Closure of a Geologic Repository at Yucca Mountain, Nye County, Nevada

This document transmits the U.S. Fish and Wildlife Service's (Service) final biological opinion based on our review of the proposed construction, operation and monitoring, and closure of a geologic repository at Yucca Mountain, Nye County, Nevada, and its effects on the federally-threatened Mojave desert tortoise (*Gopherus agassizii*) in accordance with section 7 of the Endangered Species Act of 1973, as amended (Act) (16 U.S.C. 1531 *et seq.*). Your April 24, 2000, request for formal consultation was received on May 1, 2000.

This biological opinion is based on information provided in the April 2000 biological assessment (Department of Energy [DOE] 2000a); DOE correspondence to the Field Supervisor, Nevada Fish and Wildlife Office dated April 24, 2000, September 22, 2000, October 12, 2000, February 15, 2001 (DOE 2001a), April 5, 2001 (DOE 2001b), June 12, 2001, and August 22, 2001; DOE's August 2000 correspondence with the National Marine Fisheries Service; draft environmental impact statement (DEIS) dated July 1999 (DOE 1999); biological opinions for site characterization studies at Yucca Mountain (File Nos. 1-5-90-F-6 and 1-5-96-F-307R); meetings between a DOE representative and Service staff on September 11, 1998, and March 18, 1999; conversations with DOE and representative staff; and our files. A complete administrative record of this consultation is on file in the Southern Nevada Field Office.

Consultation History

On February 9, 1990, the Service issued a non-jeopardy biological opinion to DOE for site characterization studies at Yucca Mountain (File No. 1-5-90-F-6). In the biological opinion, the

Service required DOE to continue their 1989 desert tortoise monitoring program (DOE 1989) which included the following objectives: (1) Determine relative abundance and distribution of desert tortoises on the project site, (2) implement a long-term program to monitor the relative abundance of tortoises at Yucca Mountain and the effects of site characterization activities on the species, (3) monitor the presence of any disease in desert tortoises, (4) study the movements and habitat use of desert tortoises and develop a model of desert tortoise habitat, (5) conduct field studies to determine the efficacy of relocating tortoises to new areas, (6) conduct field studies to determine the efficacy of fences and underpasses along roads to prevent vehicles from killing tortoises, and (7) monitor populations of ravens and other desert tortoise predators. These studies were conducted by DOE and their contractors at the estimated cost of \$4 million (DOE 2001b). A list of reports, publications, and abstracts provided by DOE in their April 5, 2001, letter (DOE 2001b) identifies the reference documents for these studies.

In the 1990 biological opinion, the Service determined that approximately 15 desert tortoises might be affected within the 450-acre project area. Subsequently, it became apparent that the estimated number of tortoises encountered at the project site was higher than anticipated in the previous biological opinion. On February 22, 1995, the Service requested that DOE request reinitiation of consultation for site characterization studies. By Service letter to DOE dated September 18, 1996, following the August 7, 1996, meeting among DOE and Service staff, it was mutually agreed between DOE and the Service that the continuation of project activities at Yucca Mountain would not result in DOE expenditures, studies, or monitoring in excess of those stipulated in the 1990 biological opinion (Service 1996). The Service reinitiated formal consultation on December 9, 1996, and issued a new biological opinion to DOE on July 23, 1997 (File No. 1-5-96-F-307R). This reinitiated biological opinion shall remain in effect until site characterization studies are completed.

On December 17, 1998, and February 4, 2000, DOE requested an updated species list for the project area, which was provided by the Service on January 21, 1999, (File No. 1-5-99-SP-059) and February 25, 2000 (File No. 1-5-00-SP-440), respectively.

In your April 24, 2000, letter, DOE determined that transportation of nuclear materials will involve routine transportation methods and routes and will insignificantly increase traffic volumes. Thus, DOE determined that transportation of nuclear materials from the 77 sites identified in the biological assessment will result in "no effect" to federally listed species.

DOE evaluated the potential effects to 47 federally-listed species from transportation of nuclear materials from various sites across the nation to Yucca Mountain which may involve the use of barges in the marine environment (DOE 2000b). In their DEIS, DOE showed that the likelihood of an accident involving spent nuclear fuel on a marine barge is extremely small, and the further

likelihood of an accident resulting in release of radioactivity is even smaller. Because the locations of accidents would be random, the likelihood that threatened and endangered species would be involved is reduced further. Based on these analyses, DOE concluded that the likelihood of these improbabilities resulting in an accident that may affect listed species or critical habitat, is so small that it can be considered discountable. Subsequently, on August 17, 2000, DOE determined that only the desert tortoise may be affected by the subject project (DOE 2000b).

The Service initiated formal consultation upon receipt of your request on May 1, 2000. On September 13, 2000, the Service requested a 60-day extension of the consultation period. DOE concurred with the request by letter dated September 22, 2000. Subsequently, DOE requested that the consultation period be extended to approximately November 15, 2000, to allow DOE time to refine the level of disturbance anticipated as a result of the proposed action. On February 22, 2001, the Service received DOE's modifications to the previous project description that would result in an additional 1,100 acres of disturbance of desert tortoise habitat (DOE 2001b). In response, the Service requested additional information on February 23, 2001, on the potential effects to desert tortoise that may result from the proposed modification. DOE provided that information by correspondence dated April 5, 2001 (DOE 2001a).

On May 8, 2001, the Service issued a draft biological opinion to DOE on the subject project and requested comments on the draft by May 18, 2001. On May 23, 2001, DOE requested that the deadline for comments be extended to June 15, 2001, and the opportunity to review the draft biological opinion before it is finalized. The Service concurred and received DOE's comments on the draft biological opinion on June 15, 2001. A second draft biological opinion was issued to DOE on July 26, 2001. On August 22, 2001, DOE submitted a letter to the Service stating that DOE has no further comments on the draft opinion and requested a final biological opinion on the subject project.

Description of the Proposed Action

The DOE proposes to construct, operate and monitor, and eventually close a geological repository on the Nevada Test Site (NTS) and surrounding lands at Yucca Mountain, Nevada, for the disposal of approximately 77,000 tons of commercial and DOE owned nuclear waste. The project site is located in a remote area of southern Nye County, Nevada, approximately 93 miles northwest of Las Vegas, Nevada (Figure 1). Construction, operation and monitoring, and closure of the repository will require the active use of up to 1,643 acres of land, in addition to areas used during site characterization studies, and up to 430 acre-feet of groundwater per year. The nuclear waste would consist of spent nuclear fuel and high-level nuclear waste (HLW) presently stored at 72 commercial nuclear power generating facilities and 5 DOE facilities. These materials would

be transported to a repository at Yucca Mountain using a combination of methods including barges, legal-weight trucks, heavy haul trucks, and rail. *Legal-weight trucks* have a gross vehicle weight of less than 40 tons which is the loaded weight limit for commercial vehicles operated on public highways without special state-issued permits. *Heavy-haul trucks* are overweight, over-dimension vehicles that must have permits from state highway authorities to use public highways.

The project includes the repository site (Figure 2), potential corridors within Nevada and an approximately 6-mile-long segment in California where a branch rail line may be constructed (Figure 3), potential intermodal transfer station sites (Figure 4), and potential heavy-haul routes, including areas where necessary highway upgrades may occur (Figure 5). The specific method and route of transport has not been determined at this time, therefore, the potential effects to desert tortoise that may result from transportation of materials, including construction of transportation infrastructure, will be evaluated in future consultations under section 7 of the Act. Future Federal actions will be required for proposed transportation of materials associated with the subject project including issuance of right-of-way grants and/or acquisition and expenditure of Federal highway funds. The Service anticipates that DOE would comply with the terms and conditions of biological opinions issued to other Federal agencies, as appropriate, for future transportation projects associated with the repository.

Repository Construction

DOE proposes to construct and use above- and below-ground facilities. The construction phase would likely include new construction, modification, and maintenance of infrastructure (e.g., electrical and water lines); construction of roads, buildings, parking areas, sanitary waste lines and drain fields; borrow pits; evaporation ponds; topsoil and rock storage areas; storm water retention basins; a solid waste landfill; a surface aging area; ventilation shafts; a solar power system; and underground tunnels. These facilities would be required to support receipt and repackaging of spent nuclear fuel (SNF) and HLW into waste packages, placing waste packages underground, maintaining a capability to retrieve the waste packages if needed, monitoring, and closing the repository. Most facilities developed to process SNF and HLW, and support construction of the below-ground facilities would be located in the North Portal Operations Area, the South Portal Development Operations Area, the Emplacement Ventilation Shaft Area, and the Development Ventilation Shaft Area (Figure 2).

Excavated rock (muck) from the repository would be transported through the South Portal and moved to a muck storage area on or near Midway Valley or Jackass Flats using trucks or an overland conveyor system. Site water would come from NTS J-12, J-13, and C wells, south and southeast of the North Portal Operations Area. The wells and distribution piping to the

repository already exist, however additional infrastructure may be required and routine maintenance would be performed. Sanitary sewage would be routed to septic tank/leach field wastewater-treatment systems which would be established near the facilities using them.

DOE is considering constructing a 3-megawatt solar power generating facility to meet the energy requirements of the proposed repository. The solar facility would likely be located in Midway Valley, 1.2 to 2.5 miles east or northeast of the North Portal Operations Area (Figure 2). Approximately 25 acres would be disturbed during construction of the facility and access road. A power transmission line connecting the facility to the North Portal would likely be constructed within an existing, previously disturbed right-of-way. The solar facility would be built in phases of 500 kilowatts per year, starting in 2005, and would likely be connected to the site power distribution system.

It is possible that regulatory changes would allow up to 11,000 tons of SNF and HLW to be received before the start of underground emplacement of waste packages. In this case, a concrete pad, associated facilities, and infrastructure would be constructed in or near Midway Valley for temporary holding prior to being placed underground.

Construction of the repository facilities could begin only after receipt of construction authorization from the Nuclear Regulatory Commission. DOE estimates that construction may begin in 2005. The repository surface facilities, main drifts, ventilation system, and initial emplacement drifts would be built in approximately 5 years, from 2005 to 2010. Beginning in 2010, the older and cooler commercial spent nuclear fuel could be loaded into waste packages and emplaced into the repository. Construction of emplacement drifts would continue until approximately 2032.

Repository Operation and Monitoring

Above-ground facilities would be used to receive, prepare, and repackage SNF and HLW for placement into the below ground repository. Unloading, handling, and repackaging of material would occur in a radiologically-controlled area, and would be controlled remotely. Secondary wastes generated by repository operations would include low-level radioactive, hazardous, sanitary, and industrial solid wastes. Although unlikely, small amounts of low-level mixed radioactive waste could be generated. Some wastes could be processed and/or packaged onsite. All low-level and low-level mixed waste would be shipped offsite for disposal. Hazardous waste would be packaged and shipped offsite for treatment and disposal. Industrial waste would be disposed of either offsite or in a landfill developed in the Yucca Mountain area. Sanitary liquid waste would be processed through the sanitary waste water system. Ventilation exhaust from the

repository would be a mixture of hot air (approximately 310°F) from the closed emplacement drifts, and cooler air from the open drifts where waste packages would be emplaced.

Closure/Post Closure

Closure of the repository and facilities may include decommissioning buildings and equipment; removal of equipment and other materials from the site; backfilling of the main drifts, ramps, shafts and connecting openings; and final site reclamation. Reclamation may include recontouring disturbed areas, surface backfill, soil buildup and reconditioning, site vegetation, site water course configuration, and erosion control.

Heat generated from the emplaced SNF and HLW is expected to warm the surrounding rock and soil above the repository over 750 to 2,500 acres. Increases in soil temperature are expected to begin about 200 years after waste package emplacement in the repository, and to reach maximum levels in about 700 years. DOE estimates that the temperature increase would be approximately 0.7°F for wet soil and 5°F for dry soil. The repository is designed with the capability for closure as early as 50 years, or as late as 300 years, after the start of emplacement. The period to accomplish closure would range from 6 to 15 years.

Transportation Options

The national routes taken to transport SNF and HLW to the repository would occur on the existing national transportation infrastructure of waterways, highways, and railroads. The exceptions to this are the potential construction of a branch rail line in Nevada and approximately 6 miles in California (Jean rail corridor option), potential construction of an intermodal transfer station in Nevada for the transfer of rail shipments to heavy-haul trucks, and potential modification of existing highways within Nevada to allow travel of heavy-haul trucks. For transport within Nevada, three options were considered by DOE which include (1) mostly legal-weight trucks, (2) mostly heavy-haul trucks, and (3) mostly rail.

If the rail transport option within Nevada is chosen to transport SNF and HLW to the repository, construction of a branch rail system would be required to connect the mainline rail with Yucca Mountain. If heavy-haul trucks are used, an intermodal transfer facility would be constructed where shipments would be transferred from rail cars to heavy-haul trucks for final shipment to the repository at Yucca Mountain. Five branch rail line corridors, five potential heavy-haul routes, and three general sites for potential intermodal transfer facilities have been identified within Nevada (Figure 4). Two of the three transfer facilities occur within the range of the desert tortoise but outside any areas designated for recovery of the species. The use of legal-weight truck transportation would not require construction. Legal-weight trucks would enter Nevada on

Interstate 15 from either the north or south, travel through the Las Vegas area using beltways currently under construction, and travel north on a U.S. Highway to Yucca Mountain.

Rail branch or intermodal transfer facility construction, or highway modifications will require Federal authorization or funding and, therefore, will be subject to future consultation under section 7 of the Act with the appropriate Federal agency such as the Bureau of Land Management (BLM) or the Federal Highway Administration. At that time, potential effects to desert tortoise will be identified and evaluated under the appropriate consultation procedures.

As minimization measures, DOE (2000a, 2001b) proposes the following measures to minimize effects to desert tortoises from the proposed action, which include the following:

1. All DOE and contractor personnel working at Yucca Mountain and on transportation construction projects within the range of the desert tortoise will complete a desert tortoise education program. This program will explain the legal status of desert tortoises, the definition of "take," and penalties for violations of Federal and State laws regarding tortoises. The program will include information on the life history of the desert tortoise and general tortoise activity patterns, what to do if a tortoise is sighted (including how to safely move tortoises off roads), and an explanation of measures designed to protect tortoises (e.g., speed limits, prohibition of off-road driving, etc.).
2. Clearance surveys will be conducted prior to clearing of vegetation at previously undisturbed sites if new disturbances are larger than 5 acres. Most areas where disturbances will take place have a low abundance of tortoises and the likelihood of finding tortoises in sites less than 5 acres in size is small. In addition, most smaller disturbances would be distant from larger disturbances, be short in duration, and would involve minimal equipment.
3. A tortoise biologist or environmental monitor will be available during construction activities to help ensure that desert tortoises are not inadvertently harmed. Project activities that may endanger a tortoise will cease if a tortoise is found on a project site. Project activities will resume only after a biologist or environmental monitor ensures that the tortoise is not in danger or after the tortoise has moved to a safe area.
4. All vehicles will be driven at speeds within the posted speed limits on existing roads, and will not exceed 25 miles per hour on unposted roads. Vehicles will not be driven off existing roads in non-emergency situations unless authorized by DOE. During the tortoise activity season (February 16 through November 14) the proposed vehicle path will be cleared of tortoises immediately prior to off-road travel. During the tortoise

inactive season, the proposed vehicle path will be cleared of tortoises within 7 days prior to off-road travel.

5. A litter-control program will be implemented that will include the use of covered trash receptacles, disposal of edible trash in trash receptacles following the end of each work day, and disposal of trash in a designated sanitary landfill. Any material placed in a sanitary landfill operated by the Yucca Mountain project will be covered often enough to prevent scavengers and predators from feeding there.
6. All non-linear habitat disturbances larger than 2.5 acres at Yucca Mountain which have had vegetation removed but no longer being used will be revegetated in accordance with the *Reclamation Implementation Plan* (DOE 1995) and the *Reclamation Standards and Monitoring Plan* (RSMP) (DOE 1998). These plans may include specifications for contouring, relieving soil compaction, treating and/or spreading topsoil, seeding, and using transplants.

Status of the Species- Rangewide

The desert tortoise is a large, herbivorous reptile found in portions of California, Arizona, Nevada, and Utah. It also occurs in Sonora and Sinaloa, Mexico. The Mojave population of the desert tortoise includes those animals living north and west of the Colorado River in the Mojave Desert of California, Nevada, Arizona, southwestern Utah, and in the Colorado Desert in California. Desert tortoises reach 8 to 15 inches in carapace length. Adults have a domed carapace and relatively flat, unhinged plastron. Shell color is brownish, with yellow to tan scute centers. The forelimbs are flattened and adapted for digging and burrowing. Optimal habitat has been characterized as creosote bush scrub in which precipitation ranges from 2 to 8 inches, where a diversity of perennial plants is relatively high, and production of ephemerals is high (Luckenbach 1982, Turner 1982, Turner and Brown 1982). Soils must be friable enough for digging of burrows, but firm enough so that burrows do not collapse. Desert tortoises occur from below sea level to an elevation of 7,300 feet, but the most favorable habitat occurs at elevations of approximately 1,000 to 3,000 feet (Luckenbach 1982).

Desert tortoises are most active during the spring and early summer when annual plants are most common. Additional activity occurs during warmer fall months and occasionally after summer rain storms. Desert tortoises spend the remainder of the year in burrows, escaping the extreme conditions of the desert. The size of desert tortoise home ranges vary with respect to location and year. Females have long-term home ranges that are approximately half that of the average male, which range from 25 to 200 acres (Berry 1986). Over its lifetime, each desert tortoise may

require more than 1.5 square miles of habitat and make forays of more than 7 miles at a time (Berry 1986). In drought years, the ability of tortoises to drink while surface water is available following rains may be crucial for tortoise survival. During droughts, tortoises forage over larger areas, increasing the likelihood of encounters with sources of injury or mortality including humans and other predators. Desert tortoises possess a combination of life history and reproductive characteristics which affect the ability of populations to survive external threats. Tortoises may require 20 years to reach sexual maturity (Turner et al. 1984; Bury 1987).

The desert tortoise is most commonly found within the desert scrub vegetation type, primarily in creosote bush scrub. In addition, it is found in succulent scrub, cheesebush scrub, blackbrush scrub, hopsage scrub, shadscale scrub, microphyll woodland, Mojave saltbush-allscale scrub, and scrub-steppe vegetation types of the desert and semidesert grassland complex (Service 1994). Within these vegetation types, desert tortoises potentially can survive and reproduce where their basic habitat requirements are met. These requirements include a sufficient amount and quality of forage species; shelter sites for protection from predators and environmental extremes; suitable substrates for burrowing, nesting, and overwintering; various plants for shelter; and adequate area for movement, dispersal, and gene flow. Throughout most of the Mojave Region, tortoises occur most commonly on gently sloping terrain with soils ranging from sand to sandy-gravel and with scattered shrubs, and where there is abundant inter-shrub space for growth of herbaceous plants. Throughout their range, however, tortoises can be found in steeper, rockier areas. Further information on the range, biology, and ecology of the desert tortoise can be found in Berry and Burge (1984); Burge (1978); Burge and Bradley (1976); Bury et al. (1994); Germano et al. 1994; Hovik and Hardenbrook (1989); Karl (1981, 1983a, 1983b); Luckenbach (1982); Service (1994); and Weinstein et al. (1987).

On August 4, 1989, the Service published an emergency rule listing the Mojave population of the desert tortoise as endangered (54 FR 42270). On April 2, 1990, the Service determined the Mojave population of the desert tortoise to be threatened (55 FR 12178). Reasons for the determination included loss of habitat from construction projects such as roads, housing and energy developments, and conversion of native habitat to agriculture. Grazing and off-highway vehicle (OHV) activity have degraded additional habitat. Also cited as threatening the desert tortoise's continuing existence were illegal collection by humans for pets or consumption, upper respiratory tract disease (URTD), predation on juvenile desert tortoises by common ravens (*Corvus corax*) and kit foxes (*Vulpes macrotis*), and collisions with vehicles on paved and unpaved roads. Fire is an increasingly important threat to desert tortoise habitat. Over 500,000 acres of desert lands burned in the Mojave Desert in the 1980s. Fires in Mojave desert scrub degrade or eliminate habitat for desert tortoises (Appendix D of Service 1994).